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ABSTRACT

This paper explores the roles students play in support of technology in elementary classrooms. In this ethnographic study, new models for support were developed by examining support for technology and the use of technology in three third and fourth grade classes. Data were collected through teacher interviews, informal conversations, observations of classes, and observations of meetings. The multiple observations of students giving support were analyzed, and the following categories emerged: playing; sharing; reading; small help; becoming expert; teaching; and other. Reading, small help, and teaching involved direct support from a student to either a student or a teacher. Sharing and becoming expert involved indirect support that students give. Playing included times that the students offered support in order to play. (MES)

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Supporting Technology in Elementary Classrooms: The Roles of Students

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Abstract: In this paper, the authors explore the roles students play in support of technology in elementary classrooms. The primary role of students in the classroom is not support, but teachers need to take advantage of every opportunity for support. Support takes many forms. The authors classify the ways in which students were found to support technology in the classroom, taking advantage of students' expertise to help the teacher and other students. In some cases, students' efforts provided positive benefits to the teacher and other students, and in other cases, the students' efforts caused more problems than they solved.

Introduction

Support for technology in schools comes from a variety of sources. One area that is often overlooked is the support that teachers get from their students. While students' primary purpose is not to give support to teachers, students do support teachers in a variety of ways that can be beneficial to the teachers, other students, and the students providing the support. Some of the support that students give is small help, such as answering a question for another student or the teacher, who is stuck in a program. However, students can give more extensive help when they are paired up with other students for the express purpose of helping them.

When the computer is used in a laboratory setting the teacher cannot be with every student, and when the computer is in the classroom as one activity among several (such as for science centers), the teacher cannot direct all the activities at the same time. Knowledgeable students can fill the gap in informal ways, such as answering questions as they arise, and in more formal ways, such as being assigned to teach other students.

While students helping other students can be useful to both the student being helped and the helper, it can be problematic as well. Students do not always know how to give adequate help to their peers. Sometimes the helper just wants to play with the computer, ignoring the needs of the other students, and sometimes the helper does the work himself while the one being helped just sits and watches. Students are always close at hand, but they are not always there to be helpers, and they do not always know how to help.

The case study presented in this paper looked at a public elementary school in the Midwest, focusing on three teachers for parts of two school years (all of the names in this paper are pseudonyms):

Sarah	a teacher who has been using computers in her classroom for a few years
Cindy	a teacher who has been using computers in her classroom for about a year
Jennifer	a teacher who has just started using computers in her classroom this year

While these three teachers do not cover the entire range of computer use in schools, this variation provided understanding of support from the perspectives of three teachers who seem to be at different places on Hall and Hord's (1987) levels of use and stages of concern scales. All three of the teachers taught both 3rd and 4th grades. Jennifer taught only 4th grade during the first school year of the study, and she taught only 3rd grade during the second school year of the study. Sarah and Cindy taught mixed 3rd/4th grade classes. Each of the three classrooms had one color Macintosh LC II or LC III computer, and all the computers were attached to the school's local area network, which is attached to the Internet.

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Research Methodology: Ethnography, Case Study and Situated-Evaluation

This paper is based on a larger study which combined methods of ethnography, case study, and situated-evaluation (Marcovitz, 1996), incorporating interpretations of the experiences of the participants to build an understanding of what was observed and how it relates to support for innovation. In parts of two school years, the investigator spent several hours each week at an elementary school observing classes, talking informally to teachers, interviewing teachers, and attending school and district Technology Committee meetings. The study was an exploration of the culture of the school, how technology fit into that culture, and how various members of the school supported technology.

The qualitative methodology was shaped by situated-evaluation (Bruce, 1993). In situated-evaluation, innovations are viewed as part of existing situations. Instead of viewing the innovation, or support in the case of this study, as a separate entity, it is part of the existing social system.

> In reality, the innovation is but one small addition to a complex social system. Instead of seeing it as the primary instrument of change, it is better to see it as a tool that is incorporated into ongoing processes of change. (Bruce, 1993, p. 17)

Situated-evaluation is an important way to look at support because it helps us understand why support does not always meet its objectives. A situated-evaluation approach might find that the support was inadequate because the designers of the support did not account for the contexts and constraints of the situation, or it might bring about a better understanding of how the situation and the support interact to provide different, not necessarily better or worse, support than what was originally intended.

Research Procedures

In this ethnographic study, new models for support were developed by looking closely at support for technology and the use of technology in three 3rd and 4th grade classes. Most of the investigator's time was spent with these three classes and their teachers: Sarah, Jennifer, and Cindy. Data was collected from four sources: interviews of teachers, informal conversations, observations of classes, and observations of meetings.

Interviews provided the opportunity to discuss some of the issues in detail. Each of the main participants was interviewed at least twice to explore topics in depth. Informal conversations allowed the opportunity to discuss issues as they arose, keep informed about events, and maintain an ongoing relationship with the informants. These took place regularly throughout the study, often during recess or other class breaks. Observation of classes provided the opportunity to observe the teachers' issues and needs in action and observe students in their various roles, on average once per week. Other classes using the computer laboratory were also observed. Meetings on the school and district level gave the investigator the opportunity to observe teachers interacting with each other, discussing their needs, and in some cases, acting on their needs.

Detailed notes were taken during observations. These notes were expanded each day. Notes were analyzed and coded for emergent themes and patterns. The importance of various kinds of support—including student support, student teacher support (Marcovitz, in press a), and computer coordinators (Marcovitz, in press b)—emerged from this analysis, and this led to the categories of student support described below.

Categories of Student Support

The multiple observations of students giving support were analyzed, and the following categories emerged: playing; sharing; reading; small help; becoming expert; teaching; and other. Reading, small help, and teaching involve direct support from a student to either a student or a teacher. Sharing and becoming expert involve indirect support that students give. Playing includes times that the elementary students offered support in order to play.

Playing

Elementary students spend a lot of time playing, and many of them like to play on the computer. Often they offer help as an attempt to gain more time on the computer, not to help.

> After a couple of minutes, the [Macintosh] LCIII group quit, and Jason got onto the LCIII and started playing with the EcoExplorer. He played with the simulator trying to keep the plant alive for a couple of minutes. Then he went to the song composition section. He couldn't figure out how to make a song. He needed to drag the sounds from a menu on the left into his workspace on the right for them to be added to his composition. He was just clicking on them (not dragging them) so the sound would play, but it was not added to the composition.
>
> Frank came over and said, "Let's play the game." Jason still wanted to make a song. "How do you make a song?" Frank said, "I'll show you," and he took the mouse and said, "after we play the game." (Fieldnotes, Cindy's classroom, May 11, 1993)

The computer was new to many students, and it was an attractive toy. This was not discouraged because the games (such as EcoExplorer, MathBlaster, Where in the World Is Carmen Sandiego?, InnerBody Works, and The Incredible Machine) were selected for their presumed educational value. However, in the context of students helping students, playing could be problematic when one student was looking for help, and the helper was looking to play with the computer.

The computer also served as a great source of distraction to many students, such as Marcus:

> Marcus came over several times. He tried to help them with several things. Cindy [the teacher] called him away to do spelling, but he stayed by the computer to give them more advice. Cindy called him again, "Marcus, this is the third time." He went with her. But Cindy went back to her desk for a minute, and Marcus went back to the computer. (Fieldnotes, Cindy's classroom, February 28, 1994)

Marcus liked to avoid his other classwork by going over to the computer and trying to help others.

Sharing

Sometimes students offer support by sharing their experiences with the rest of the class. For example:

> Sarah [the teacher] had all the kids gather in a circle. She said that one of the kids (Ken) had run into some problems, and she wanted to talk about it and show what he did to solve the problem. He had created his stack, but he wasn't able to get a new card or a new stack or a new field. He described the problem, Sarah explained what he was saying. Sally (a volunteer with Sarah's after-school class) showed them how to get around the problem. (Fieldnotes, Sarah's after-school program, October 26, 1993)

One of Sarah's students had run into a problem that she thought others might encounter. After they solved the problem, Sarah had the student share the solution with the class. Whether it was the teacher, the volunteer, or the student who solved the problem was unclear, but the student was actively involved with presenting the solution.

This was part of Sarah's after-school class in which she worked with 3rd grade students on a HyperCard project. Overall, no one had a lot of experience with HyperCard so the class spent a lot of time exploring and learning about it. In this exploratory environment, sharing was important—including students sharing with each other and the teacher, and the teacher sharing with the students.

Reading

Many of the computer activities involved a great deal of reading. As 3rd and/or 4th grade teachers, Sarah, Cindy, and Jennifer had students at a variety of levels of reading, including some who had a great deal of trouble reading instructions on the computer.

> At 10:06 a.m., Sarah started talking to the class about Oregon Trail. She assigned partners to some of the slower readers. (Fieldnotes, Sarah's class at the university computer laboratory, September 23, 1993)

> Cindy said they were about ready to get started, and the kids started to head to the computers. She stopped them and was mildly upset. When they settled back into their seats, she reviewed how to get to the tutorial, and she assigned partners to some of the slower readers. (Fieldnotes, Cindy's class at the university computer laboratory, September 30, 1993)

In some situations, the teacher or another adult (volunteer, student teacher) helped some of the slower students with the reading, but this can be draining on the adults' time. As in these examples, some teachers have found that pairing slower readers with faster readers allows the adults to spend more time with other problems. These examples are from laboratory situations, but this kind of support can be very effective in the classroom as well. Often the teacher is working with a group of students and can not spend the time to work with a student on the computer.

Small Help

Small help refers to the small ways that students help other students or the teacher, usually by answering a question or showing how to do something on the computer. Students working on the computer will often get stuck with a problem. Other students are always around, some of whom know the solution to the problem.

> One student didn't know how to change the names in the party [in the game Oregon Trail]. The volunteer did not know either. The parent said, "She made it turn red. How did she do that?" A kid at the next computer showed them how to do it. (Fieldnotes, Nora's class at the university computer laboratory, September 28, 1993)

> One of the options for erasing [in KidPix] is the firecracker. Jennifer tried to show them this option, but she couldn't get it to work. She clicked on the eraser on the left, and then she clicked on the firecracker on the bottom, but nothing happened. She didn't realize that once she selected the firecracker tool, she had to click on the screen to get it to erase. One of the kids pointed this out to her, and she said "Oh, yeah", and then showed it to the rest of the class. (Fieldnotes, Jennifer's class at the university computer laboratory, October 20, 1993)

Often students become experts or at least knowledgeable helpers and can answer small questions. Although none were observed in these classes, many times students become technical experts, answering questions about configuring software and setting up equipment (matters beyond help with how to play an educational game). Students with expertise at all levels can be very helpful due to their proximity; they are very close to the situation where help is needed and, in some cases, even closer than the teacher.

Small help has its drawbacks as well. Elementary students are often more interested in playing than helping, and they might use offers of small help to get onto the computer. An additional drawback is that children are not trained as helpers or teachers, and when they are given the opportunity, they often give the answer or do the work for someone rather than giving hints or explaining how it should be done.

> Brad came over and said that he had won the game. He asked if they had. They said they were close. They asked him where the antidote was. He wouldn't tell them. He gave them hints. They tried again to find it and couldn't. Finally, Brad agreed to do it for them, and they let him sit down (at first they just wanted him to tell them). (Fieldnotes, Cindy's classroom, May 11, 1993)

> They were having a lot of trouble solving the first puzzle. They went to get help from Tim. Tim came over and did the puzzle for them. (Fieldnotes, Cindy's classroom, February 28, 1994)

Small help can be beneficial when the students answer simple questions and help others to get past roadblocks, but it can be a problem when they do the work for other students.

Becoming Expert

During the 1993-94 school year, Sarah worked with several students in an after-school program to train them how to use HyperCard. The students she trained were 3rd graders from her class and Cindy's class. The goal of the program was for these students to become proficient enough in HyperCard so they could train others the following year. The 3rd graders would be 4th graders the following year and still in the Sarah and Cindy's classes.

Sarah made an investment in her students and the use of HyperCard as an integral part of her curriculum. Many of the other types of support that students offered were almost "free" to the teachers, requiring little or no effort on their part beyond creating an environment in which students were free to help others. Having the students become experts required a significant investment in time on Sarah's part. Sarah had been inspired by other projects in her classroom and discussions with others about the effectiveness of HyperCard in her program. She lacked the expertise in HyperCard and a core of experts to help in her class. Sarah got connected with Sally, a university student, to help her for a short time, but she needed a continuing core of experts, which she created from her students.

Teaching

After becoming experts, students were enlisted to teach other students. HyperCard is a fairly complex program that requires a great deal of training, but other programs require a smaller amount of training, and students could easily learn the program and be used to train other students. Cindy did this with The Incredible Machine, a game that explores the construction of simple machines.

> I have a child in my room who bought it for home, and two of Sarah's children came in and trained two of mine, and then we went from there, 'cause she did it first. And then we matched up kids who now taught everybody in the class. We had a lot of collaboration and peer work (Cindy, interview, May 2, 1994)

As with small help, Cindy took advantage of the proximity of experts: her students. She might not have had the time to teach all her students how to use The Incredible Machine without the help of her students. Having a core of experts, at close proximity, to teach others is difficult without using students for support.

Other

The categories of student support listed above were the most prominent ones observed, but students helped in a variety of other less specific ways. Teachers got support from the ability of students to learn the technology on their own. This helped the teachers spend time on other things and not worry about the students learning the technology.

> She said she is not worried about support for Lego Logo. She said the kids are doing well and can mostly learn it themselves. Though she admitted that it might get complicated. (Fieldnotes, discussion with Sarah about Lego Logo, February 15, 1994)

Teachers got support by learning with the students.

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> At 10:49 a.m., two boys (who I think had played before) started a full game [of SimAnt]. Cindy asked if she could sit with them. "You see, I'm learning along with you guys." (Fieldnotes, Cindy's class at the university computer laboratory, September 30, 1993)

In earlier categories, students gave support by answering questions (small help) and teaching other students. Teachers also got support from knowing that students who could answer questions were around, whether or not they actually did anything.

> At 10:20 a.m., she started talking about Oregon Trail. She asked how many had played before. Nine raised their hands. She said that they could ask the kids who had played before or [the student teacher] or herself for help. (Fieldnotes, Virginia's class at the university computer laboratory, October 7, 1993)

All of these other forms of support relied on the proximity of students, mostly to be where the teacher was not or could not be.

Discussion

In terms of support received by the teacher, the most significant categories of support are becoming expert, teaching, and other. These were most significant because the teachers were able to change their curricula in ways that might not have otherwise been possible.

In becoming expert, the teacher was relying on the proximity of a core of experts. The support was not added on later but was an integral part of the development of the curriculum.

Teaching was the logical step after becoming expert and part of the process of developing the curriculum. Student support was necessary to implement the teachers' ideas.

The other category was significant because it relied on the students to be helpers. The actual support given was not necessarily more than small help, but the reliance of the teacher on that help made it important.

The reading category can be critical to the students who have trouble reading. Without this kind of support, the teacher or other adults would have to spend more time with the poor readers. Otherwise, the issue of equity among students could become a major problem for the teacher. Allowing students to help each other with reading allows all students access to the computer.

Small help is the most common form of support. Except in the cases where the teacher relies upon it, this kind of support does not have a major impact on the classroom. It is helpful and, because it is so common, it appears to be the most significant, but the students giving this kind of support are often not credible helpers and not relevant to the needs of the teacher or the student being helped. Playing can be viewed as small help taken to the least relevant extreme, where one student is offering support merely for the opportunity to play.

The instances of sharing observed were not significant in and of themselves, but they helped to create an atmosphere that encouraged helping others.

Proximity is the key to student support in the classroom because students are always present. This is most significant when a core of experts is formed, always available to help.

Proximity and a feeling of credibility toward the student allow the teacher more flexibility to create student support to do what she feels is relevant (such as HyperCard in Sarah's class). The student support is relevant because it is created by the teacher to be relevant. When students have their own agendas (such as playing and wanting to do things for others), their support becomes less relevant and thus less supportive.

As teachers view students as credible supporters/experts, the support and the curriculum can be expanded in more than simple ways. Small help is useful, but Cindy's addition of The Incredible Machine was more useful and made possible by her relying on her students. Sarah took it one step further by relying on her students to help her implement a major addition to her curriculum with HyperCard.

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